

What is claimed is:

1. An apparatus for processing protocol layers of an Ethernet passive optical network (PON), the apparatus comprising:

an Emulation sublayer processing unit which performs cyclic redundancy check (CRC) on information included in a preamble of an Ethernet data frame transferred from a physical layer processing unit, and extracts LLIDs from the preamble;

a MAC sublayer processing unit, which has one MAC address corresponding to multiple LLID indexes corresponding to the extracted LLIDs, to perform control and management;

a MAC control sublayer processing unit which contains information of the multiple LLID indexes, and performs MAC control on each LLID index;

a PON bridge sublayer processing unit which performs a bridge function of the Ethernet PON and tag management of the Ethernet PON; and

an Emulated-MAC sublayer processing unit which performs upstream and downstream Ethernet data frame matching, FCS error checking, and PAUSE frame processing.

2. The apparatus of claim 1, wherein the MAC sublayer processing unit comprises:

a MAC sending unit, which obtains a 32-bit FCS for received data, and attaches the FCS to the data and transfers data to the Emulation sublayer if the received data is an Ethernet data frame transferred from an MPCP function unit of the MAC control sublayer processing unit, whereas the MAC sending unit transfers received data to the Emulation sublayer processing unit, in the state of including FCS, if the received data is an Ethernet data frame transferred from the PON bridge sublayer processing unit;

a MAC control unit which manages various registers related to the MAC sublayer processing unit and provides CPU interface functions; and

a MAC receiving unit which performs an FCS error check and address filtering for an Ethernet data frame transferred to the MAC control sublayer processing unit, and checks contents of the Ethernet data frame to determine whether the Ethernet data frame is to be transferred to the MPCP function unit or to be transferred to the PON bridge sublayer processing unit.

3. The apparatus of claim 1, wherein the MAC sublayer processing unit comprises:

an FCS generation unit which determines whether an Ethernet data frame received from the MAC control sublayer processing unit is data transmitted from the MPCP function unit or data transmitted from the PON bridge sublayer processing unit, and generates an FCS value of the Ethernet data frame, inserts an inter frame gap (IFG) in the Ethernet data frame, and outputs a resultant Ethernet data frame if the Ethernet data frame is data transmitted from the MPCP function unit;

a downstream data processing unit which extracts LLID information from the Ethernet data frames, and stores transmission state information of the Ethernet data frames, which correspond to the extracted LLID values, in a sending MIB counter;

a downstream data matching unit which converts a 32-bit format of Ethernet frame data transferred from the downstream data processing unit into a 8-bit format of Ethernet frame data to be matched with the Emulation sublayer;

an FCS error check unit which detects whether any Ethernet data frame received from a lower layer is corrupted;

an upstream data matching unit, which converts the 8-bit format of data that has passed through the FCS error check unit into a 32-bit format that is matched with a system clock;

an address filtering unit, which reads a value of a destination address (DA) field of a received Ethernet data frame and checks the value included in the DA field;

an upstream data processing unit, which transfers a signal to the MAC control sublayer processing unit for determining transmission direction of the Ethernet data frame based on a checked result of the address filtering unit; and

an unit which extracts LLID information from upstream data, the unit including a counter for the LLID information, and receives and manages a plurality of MAC addresses through one MAC sublayer processing step.

4. The apparatus of claim 3, wherein the FCS error check unit unconditionally discards contents stored in a receiving buffer if any error is found, and stores information indicating that the contents stored in the receiving buffer have been discarded, in the counter corresponding to the extracted LLID information.

5. The apparatus of claim 3, wherein the address filtering unit comprises a content addressable memory (CAM) having a plurality of storage spaces which pre-stores MAC addresses therein, wherein if an input address is identical to one among the MAC addresses stored in the CAM, the address filtering unit outputs contents of the identical address.

6. A method for sending and receiving an Ethernet data frame between an Emulation sublayer and a MAC sublayer, the method comprising:

generating an Ethernet data frame which includes LLID information written on a 8-bit preamble header;

generating an enable signal for distinguishing the 8-bit preamble area; and

extracting the LLID information separately using the enable signal, converting the extracted LLID information into format of an interface used in the Emulation sublayer, and transferring resultant LLID information to a MAC control sublayer.

7. The method of claim 6, wherein in transferring the LLID information to the MAC control sublayer, if the Ethernet data frame is to be transmitted to an MPCP function unit, the Ethernet data frame is transferred without FCS, and if the Ethernet data frame is to be transmitted to a PON bridge, the Ethernet data frame is transferred with FCS if no error is found after performing FCS error checking.

8. The method of claim 6, wherein in transferring the LLID information to the MAC control sublayer, if a downstream Ethernet data frame is data transmitted from an MPCP function unit, the downstream Ethernet data frame is transferred without FCS, and if a downstream Ethernet data frame is data transmitted from a PON bridge, the data is transferred with FCS to a PON bridge if no error is found after performing the FCS error checking.

9. A method of processing downstream data in a MAC sublayer of an Ethernet PON, the method comprising:

receiving an Ethernet frame;

determining whether the received Ethernet frame is data transferred from an MPCP function unit;

if it is determined that the Ethernet frame is data transferred from the MPCP function unit, performing cyclic redundancy check (CRC) to add a frame check sequence (FCS) value to the Ethernet frame, inserting an inter frame gap (IFG) into the Ethernet frame, and extracting LLID from the Ethernet frame, whereas if it is  
5 determined that the Ethernet frame is data transferred from a PON bridge sublayer, inserting an IFG into the Ethernet frame and extracting LLID from the Ethernet frame without performing the CRC; and

if it is determined that the Ethernet frame is not data transferred from the MPCP function, generating a new FCS value, including the FCS value in the  
10 Ethernet frame, and including an LLID value for the Ethernet frame at a preamble interval thereof to thereby output a resultant Ethernet frame.

10. The method of claim 9, wherein if it is determined that the Ethernet frame is not data transferred from the MPCP function unit, the Ethernet frame is output with  
15 the LLID value included in the preamble interval thereof as well as the FCS value input initially, wherein a delay time between an input and an output is maintained as the same as in the frame processed by the MPCP function unit.

11. A method of processing upstream data in a MAC sublayer of an  
20 Ethernet PON, the method comprising:

receiving an Ethernet frame;

performing FCS error check of the received Ethernet frame;

if any error is found in performing the FCS error check, discarding the current Ethernet frame and storing information indicating that the current Ethernet frame has  
25 been discarded, in a register corresponding to an LLID of the Ethernet frame, and if no error is found, extracting a destination address (DA) of the current Ethernet frame, and determining whether the extracted DA is an exact address (one among addresses allocated to the MAC sublayer);

if it is determined that the extracted DA is the exact address, outputting the  
30 Ethernet frame including an LLID and without an FCS value to an MPCP function unit, and if it is determined that the extracted DA is not the exact address, determining whether the extracted DA is a link specific address;

if it is determined that the extracted DA is the link specific address, outputting the Ethernet frame, including the LLID and without the FCS value. to the MPCP

function unit, and if the DA is not the link specific address, determining whether the DA is a broadcasting address; and

if it is determined that the extracted DA is the broadcasting address, simultaneously outputting the Ethernet frame, including both the FCS value and LLID, to both the MPCP function unit and the PON bridge sublayer, and if the DA is not the broadcasting address, outputting the Ethernet frame, including both the FCS value and LLID, to the PON bridge sublayer.